DEPARTMENT OF TRANSPORTATION
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December 13, 2001

04-SF,Ala-80-13.9/14.3,0.0/1.6
04-012024
ACIM-080-1(085)8N

Addendum No. 12

Dear Contractor:

This addendum is being issued to the contract for construction on State highway in THE CITY AND COUNTY OF SAN FRANCISCO AND ALAMEDA COUNTY IN SAN FRANCISCO AND OAKLAND FROM 1.3 km TO 3.3 km EAST OF THE YERBA BUENA ISLAND TUNNEL EAST PORTAL.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on December 19, 2001.

This addendum is being issued to revise the Project Plans and the Notice to Contractors and Special Provisions.

On Project Plan Sheet 25, under "Legend," "04-012044 Contractor Access Area" is revised to read "Adjacent Contractor Marine Access Area."

On Project Plan Sheet 25, under "Legend," "04-012024 Contractor access area" and its corresponding cross hatched symbol are deleted.

On Project Plan Sheet 25, the cross hatched area shown for "04-012024 Contractor access area" is deleted.

On Project Plan Sheet 436, under "GENERAL NOTES LOAD FACTOR DESIGN," item "DESIGN" is revised as follows:

"Design Criteria, Skyway Structures, dated February 26, 2001.
Caltrans Bridge Design Specifications, 1995."

On Project Plan Sheet 486, detail "PLAN (PIERS E3 THRU E14)", in the upper right, the callout "Pile sleeve PL 68 "Through thickness, quality steel". See "Pile Head Connection Detail" Typ" is revised to "Pile sleeve PL 60 "Through thickness, quality steel". See "Pile Head Connection Detail" Typ".

On Project Plan Sheet 685. Note 8 is revised as follows:

"Grout for prestressing ducts shall attain a strength of 20 MPa minimum before subjected to stresses due to segment hoist loading, and 30 MPa minimum before subjected to stresses due to subsequent loadings."

On Project Plan Sheets 916A, 916B, 916C, 917, 918, 919, 920, 921, 922, and 923 the following note is added:

"The design of these structures is based on the construction sequence, methods, and equipment loads as shown on the plans. Not all details for construction sequence and construction methods are shown.

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The Contractor shall develop, verify and provide the Contractor's own sequence, means, and methods that are based on the Contractor's proposed erection equipment, the Contractor's erection schedule, and the Contractor's concrete mix design and actual material properties. Any modification of the plans to accommodate specified options and the Contractor's construction equipment, means and methods shall be performed by the Contractor and submitted to the Engineer for approval as specified in the contract Special Provisions."

In the Special Provisions, Section 2-1.04 "ESCROW OF BID DOCUMENTATION," the seventh and eighth paragraphs are revised as follows:

"The bid documentation shall include, but not be limited to: quantity takeoffs; rate schedules for the direct costs and the time- and nontime-related indirect costs for labor (by craft), plant and equipment ownership and operation, permanent and expendable materials, insurance and subcontracted work; estimated construction schedules, including sequence and duration and development of production rates; quotations, scoping documents and subcontracts or purchase orders related to subcontractors, manufacturers and suppliers; estimates of field and home office overhead; contingency and margin for each contract item of work; names of the persons responsible for preparing the bidder's estimate, and other reports, calculations, assumptions and information used by the bidder to arrive at the estimate submitted with the proposal.

The Contractor shall also submit bid documentation for each subcontractor, manufacturer and supplier whose total subcontract or purchase orders exceeds $250,000. Subcontractor, manufacturer and supplier bid documentation shall be enclosed with the Contractor's submittal. If at the time that bid documentation is submitted for escrow, the subcontractor, manufacturer or supplier does not have a executed subcontract or purchase orders, and a subcontract or purchase orders is subsequently executed, then a copy of the executed subcontract or purchase orders shall be submitted into escrow within 14 days of the execution of the respective subcontract or purchase orders. The examination of subcontractors', manufacturers' and suppliers' bid documentation will be accomplished in the same manner as for the Contractor's bid documentation. If a subcontractor, manufacturer or supplier is replaced, bid documentation for the new subcontractor, manufacturer or supplier shall be submitted for review and escrow before authorization for the substitution will be granted. Upon request of a subcontractor, manufacturer or supplier, the bid documentation from that subcontractor, manufacturer or supplier shall be reviewed only by the subcontractor, manufacturer or supplier and the Department."

In the Special Provisions, Section 4, "BEGINNING OF WORK, TIME OF COMPLETION AND LIQUIDATED DAMAGES," the second sentence of fifth paragraph is revised as follows:

"The Contractor shall not have exclusive right to use the marine access areas for adjacent contracts as shown on the plans and shall evacuate all marine access areas after 500 working days beginning on the fifteenth calendar day after the approval of the contract."

In the Special Provisions, Section 10-1.01, "ORDER OF WORK," the third paragraph is revised as follows:

"As first order of work, the Contractor shall complete all work within the designated area, marine access areas, as shown on the plans, no later than 500 working days beginning fifteen days after the approval of the contract. The Contractor shall vacate all designated marine access areas and shall not interfere with the adjacent contractor's access to these areas."

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In the Special Provisions, Section 10-1.23, "DREDGING," the tenth paragraph is revised as follows:

"The total amount of dredged material for access dredging as shown on the plans shall not exceed 104,000 cubic meters. The combined total amount of dredged and excavated materials for all construction work, including but not limited to, dredged material for access dredging (including dredging for barge access), structure excavation, removal of materials in cast-in-steel shell concrete piling, dredging for trestles, and dredging for temporary towers, over-excavation, and maintenance dredging operations, shall not exceed 450,000 cubic meters."

In the Special Provisions, Section 10-1.24A, "MARINE PILE DRIVING ENERGY ATTENUATOR," the following paragraph is added after the fourth paragraph:

"The Contractor shall provide adequate means to prevent light from pile driving operations from shining directly into the water. At least 15 minutes prior to and during pile driving operations, the Contractor shall not shine light directly into the water in areas adjacent to piles being driven."

In the Special Provisions, Section 10-1.24A, "MARINE PILE DRIVING ENERGY ATTENUATOR," subsection "WORKING DRAWINGS," the following item is added to the third paragraph:

"E. Description of measures taken to avoid shining light directly into the water during pile driving operations."

In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," the fifteenth paragraph is revised as follows:

"The 56-day compressive strengths shown on the plans for pile concrete shall be a requirement for acceptance of the concrete."

In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," subsection "LIGHTWEIGHT CONCRETE," subsection "Lightweight Concrete Panel And Cast-In-Place Concrete For Closure Segments," the twenty-second paragraph is replaced with the following paragraphs:

"The Contractor shall submit to the Engineer an erection plan for precast lightweight concrete panels to be erected at pier tables. The erection plan shall be in conformance with "WORKING DRAWING," of these special provisions. This erection plan shall include the following:

A. Details of handling, storing, and shipping the panels.
B. Step-by-step erection procedures and the equipment information and details that are to be used for erection of the panels.
C. Locations and details of the lifting devices cast into precast lightweight concrete panels.
D. Details of any localized strengthening consisting of bar reinforcement (that is in addition to that shown on the plans) to be placed for concentrated loads induced by lifting operations and all other temporary construction loads.
E. Substantiating stress and load calculations for precast lightweight concrete panels subject to lifting forces and all other temporary construction loads at every stage of handling, storage, shipping, and erection.

After a complete erection plan submittal has been received as determined by the Engineer, the Contractor shall allow the Engineer 20 working days to review the complete submittal."

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In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," subsection "MASS CONCRETE," the following paragraphs are added after the sixth paragraph:

"As a minimum, the concrete temperatures shall be monitored on the first 5 structural components of each type, including 5 piles, 5 pile caps, 5 pier columns, 5 pier table diaphragms, and 5 pier table soffits. If the Contractor elects to cast components of the same type on the same day, only one of the components shall be monitored and counted as part of the initial five. If the Contractor elects to use multiple lifts for concrete placement of a structural component, then the first N lifts of each component shall be monitored. The value of N shall be 5 except, if less than 5 lifts are used for a component, then N shall be the number of all lifts. A minimum of 5N lifts, each from 5 separate components of the same type, shall be monitored if multiple lifts are used. Thereafter, upon evidence of consistently meeting the requirements of these specifications and the Thermal Control Plan for 5 consecutive, except as specified herein, components of each type, the requirements for monitoring may be reduced to a minimum of monitoring 5 percent of the mass concrete placements of each type in a 6-month period. The components that the Contractor plans to monitor shall be listed in the Thermal Control Plan.

Upon evidence of consistent reliability of the primary set of thermocouples in the first 10 concrete placements, the requirements for a redundant set of thermocouples may be reduced or eliminated. If reliability of the primary set is not maintained, the Contractor shall install a redundant set until reliability is again established."

In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," subsection "MASS CONCRETE," the ninth paragraph is revised as follows:

"Cracks greater than 0.15 mm in width shall be repaired. Cracks greater than 0.15 mm in width and longer than 300 mm shall be filled with pressure-injected epoxy. Cracks to be filled shall be cleaned and filled by pressure injection methods so that all portions of the crack are completely filled with epoxy. No repairs shall begin until the Engineer has approved the repair plan."

In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," subsection "COST REDUCTION INCENTIVE PROPOSALS FOR PRECAST CONCRETE SEGMENTS," item E of the eleventh paragraph is deleted.

In the Special Provisions, Section 10-1.27, "CONCRETE STRUCTURES," subsection "COST REDUCTION INCENTIVE PROPOSALS FOR PRECAST CONCRETE SEGMENTS," the thirteenth paragraph is revised as follows:

"In addition, CRIPs shall conform to the following analysis and design requirements:

A. The Contractor shall submit detailed calculations for the superstructure and pier stresses, accounting for the construction sequence, schedule and material properties.
B. The Contractor shall submit the analysis results that are computed from a time-dependent segmental analysis software program. These results shall be combined with all other required load cases as defined in the Project Design Criteria. The reported resultant stresses shall conform to the requirements as specified in the Project Design Criteria.
C. The Contractor shall use for his time dependent analysis, the creep and shrinkage models based on CEB-FIP Model Code 1978 for Concrete Structures, adjusted to reflect the results of the materials tests required for structural concrete specified elsewhere in these special provisions. The design is based on an ultimate creep coefficient $\varphi_t = 2.35$, for the bridge conditions, at a loading age of 28 days and an ultimate shrinkage strain $\varepsilon_{ult} = 224 \times 10^{-6}$, for the bridge conditions.

D. The Contractor shall request, in writing, from the Engineer the soil and foundation stiffness defined as vertical, horizontal and rotational springs at the base of each pier and the superstructure and pier force demands due to live load, centrifugal force, wind, wind on live load, longitudinal force from live load, temperature rise and fall, temperature gradient, and seismic forces.

E. The Contractor shall submit design calculations for the completed structure.

F. The calculations submitted by the Contractor shall also include the following:

1. Camber calculations including camber diagrams, casting curves, final profile grades, and erection elevations in accordance with the Contractor's chosen construction method, sequence, and schedule.
2. Calculations including the effects of construction sequence and history as well as the effects of temporary construction loads shall conform to Section 7.4 for the AASHTO Guide Specifications titled "Construction Load Combinations, Stresses and Stability." Pier stresses due to unbalanced cantilever loading shall not exceed:

$$0.62\sqrt{f_c'}\ \text{MPa}$$

Where f_c' is specified concrete strength, for Construction Load Combinations of the AASHTO Guide Specifications.

3. Calculations showing that for the completed structure, based on the actual construction sequence, erection schedule and the material properties, at end of construction and at ten years after completion of construction, for load combinations defined in the Project Design Criteria, the maximum and minimum stresses and ultimate strengths conform to the limits defined by the Project Design Criteria.
4. The stresses in the pipe beams at the hinge locations, at the end of construction and at ten years after completion of construction, for load combinations defined in the Project Design Criteria, shall not exceed $0.66F_y$, where F_y is the yield stress of steel.
5. Calculations showing that for the completed structure at end of construction and at 10 years after completion of construction, pier force demands shall satisfy the following equation:

$$\frac{M_2}{M_{n2}} + \frac{M_3}{M_{n3}} \le 0.7$$

Where M_2 and M_3 are factored moments about the longitudinal and transverse axes of the pier based on Table 2.8.1B in the Project Design Criteria, and M_{n2} and M_{n3} are the longitudinal and transverse nominal flexural capacities of the pier based on a concrete strain of 0.003.

Under no circumstances shall the bending moments about the weak axis at the top and bottom of the piers due to dead load, pre-stressing, creep and shrinkage, at end of construction and at 10 years after completion of construction, exceed 250 MN-m for Frames 1, 2, and 3 and 170 MN-m for Frame 4.

6. Stresses for each segment shall also be calculated and reported for the following intermediate construction stages:

    a. Immediately after erecting or placing concrete in each segment.
    b. Immediately after stressing cantilever tendons.

c. Immediately prior to, and after jacking operations at closure.
d. Immediately prior to, and after, placement of closure concrete.
e. Immediately prior to, and after, stressing of the first stage post-tensioning through the closure prior to release of the closure formwork.
f. Immediately after the release of the closure formwork.
g. Following completion of span post tensioning tendons.
h. Following completion of continuity post-tensioning tendons.
i. Prior to and after all steps of hinge construction.
j. Prior to and after removal of all temporary towers.

G. The Contractor's chosen construction method, sequence, and schedule shall be reflected in the Casting Manual and Erection Manual as specified elsewhere in these special provisions."

In the Special Provisions, Section 10-1.29, "FURNISH PRECAST CONCRETE SEGMENT," subsections "GENERAL," and "WORKING DRAWINGS," are revised as attached.

In the Special Provisions, Section 10-1.29, "FURNISH PRECAST CONCRETE SEGMENT," subsection "MEASUREMENT AND PAYMENT," the fourth paragraph is replaced with the following paragraphs:

"The contract price paid per cubic meter for furnish precast concrete segment shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, including reinforcing and prestressing steel as required, and for doing all work involved in constructing, furnishing, storing, and transporting precast concrete segment to the site of the work complete and ready for erection, furnishing the casting manual, and providing the surveying for geometry control, as shown on the plans, as specified in the Standard Specifications, and these special provisions.

Full compensation for development, submittal, investigation, and review of the Contractor's construction sequences, means and methods shall be considered as included in the contract price paid per cubic meter for furnish precast concrete segment and no additional compensation will be allowed therefor.

No extension of time and no delay will be granted for the Contractor's use of allowable options as specified herein."

In the Special Provisions, Section 10-1.30, "ERECT PRECAST CONCRETE SEGMENT," subsection "APPLICATION OF EPOXY BONDING AGENT," the first sentence of the fifth paragraph is revised as follows:

"Immediately after both faces are covered with epoxy, the unit shall be brought into position and the designated prestress applied."

In the Special Provisions, Section 10-1.31, "JACK SUPERSTRUCTURE," subsection "GENERAL," the second paragraph is revised as follows:

"The jacking system shall be designed for 175% of estimated forces as shown on the plans and shall take into account for Frame 1 horizontal curvature. The Contractor shall design the jacking system to ensure no tension occurs in the closure concrete during the entire jacking operation including removal or destressing of the jacks."

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In the Special Provisions, Section 10-1.31, "JACK SUPERSTRUCTURE," subsection "GENERAL," the following paragraph is added after the third paragraph:

"The location, estimated jacking force, and imposed displacement across the closure shall conform to the following values:

FRAME	JACKING SPAN	ESTIMATED JACKING FORCES	IMPOSED DISPLACEMENT ACROSS CLOSURE
W1	E5W	25 MN	140 mm
E1	E5E	25 MN	140 mm
W2	E9W	25 MN	110 mm
E2	E9E	25 MN	110 mm
W3	E13W	40 MN	100 mm
E3	E13E	40 MN	100 mm

In the Special Provisions, Section 10-1.31, "JACK SUPERSTRUCTURE," subsection "CONSTRUCTION," the third paragraph is revised as follows:

"During the jacking operation, the Contractor shall observe the structure movements and record the jacking force, longitudinal displacement, and transverse displacement. The longitudinal displacements shall not exceed the values as shown on the plans. The records shall be submitted to the Engineer for review."

In the Special Provisions, Section 10-1.44, "STEEL STRUCTURES," subsection "FIELD WELDING," requirement F of the fifth paragraph is revised as follows:

"F. The preheat and interpass temperature shall be in conformance with AWS D1.5, and the minimum preheat and interpass temperature shall be 65°C. In the event welding is interrupted, preheating to 65°C must occur before welding is resumed. For welds with required preheat temperatures greater than 65°C, the minimum preheat temperature shall be maintained continuously from beginning to completion of the entire weld, even if welding is interrupted. Preheat temperatures shall be achieved and maintained using electric resistance heating bands for the entire length of the weld. The heaters shall be controlled by attached thermocouples at spacing not exceeding 2 m."

In the Special Provisions, Section 10-1.44, "STEEL STRUCTURES," subsection "FIELD WELDING NONDESTRUCTIVE TESTING FOR PILE HEAD CONNECTION PLATES," item B of the first paragraph is revised as follows:

"B. UT shall be used for each complete joint penetration (CJP) field weld. UT shall be performed over the full length of each CJP weld. The acceptance criteria shall conform to the requirements of AWS D1.5 for connections subject to tensile stress."

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In the Special Provisions, Section 10-1.44, "STEEL STRUCTURES," subsection "FIELD WELDING NONDESTRUCTIVE TESTING FOR PILE HEAD CONNECTION PLATES," the following items are added to the first paragraph:

"C. The full length of each PJP connection plate weld to the pile and sleeve shall be examined using the approved UT procedure described below to verify that the required depth of penetration has been achieved.

The Contractor shall develop a UT procedure to verify the depth of penetration of the partial joint penetration (PJP) connection plate welds to the pile and sleeve. The procedure shall be used to examine the mock-up welds. The mock-up welds shall be sectioned at a minimum of three locations, as selected by the Engineer, to validate the UT procedure. The UT procedure shall define all techniques, including probe types and angles, and shall be approved by the Engineer before use.

Each UT technician that will perform this inspection shall have passed Caltrans' Ultrasonic Test and then demonstrate their ability to detect penetration depth using the full-scale mock-up to the satisfaction of the Engineer. Information regarding the Caltrans Ultrasonic Test (titled "Notification of California Department of Transportation Qualification Requirement for Ultrasonic Testing Personnel") is included in the "Information Handout," available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specification, Contract and Site of Work," of the Standard Specifications.

D. MT shall be used for 100% of all partial joint penetration (PJP) and fillet welds. The acceptance criteria shall conform to the requirements of AWS D1.5 for connections subject to tensile stress. UT and MT shall be performed, after the weld has cooled to ambient temperature, in accordance with a written procedure that shall be approved by the Engineer before use. "

To Proposal and Contract book holders:

Attached is a CD of the U.S. ARMY CORPS OF ENGINEERS PERMIT and a copy of the Materials Information supplement containing the CONCEPTUAL STORM WATER POLLUTION PREVENTION PLAN (JULY 2001). Also attached is a hard copy of the U.S. COAST GUARD PERMIT.

Indicate receipt of this addendum by filling in the number of this addendum in the space provided on the signature page of the proposal.

Submit bids in the Proposal and Contract book you now possess. Holders who have already mailed their book will be contacted to arrange for the return of their book.

Inform subcontractors and suppliers as necessary.

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This office is sending this addendum by UPS overnight mail to Proposal and Contract book holders to ensure that each receives it.

If you are not a Proposal and Contract book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

ORIGINAL SIGNED BY

REBECCA D. HARNAGEL, Chief
Office of Plans, Specifications & Estimates
Office Engineer

Attachments

GENERAL

This work shall consist of performing all operations necessary to construct precast concrete segments including construction sequence analysis, manufacturing, storage, and transportation of the segments to the bridge site. The segments shall be furnished complete including all concrete, transverse prestressing steel, bar reinforcing steel, miscellaneous metal, utility ducts, prestressing steel ducts, anchorages, and other appurtenances in connection therewith.

Precast concrete segment age is measured from the date a segment casting is complete. Prior to release for erection, furnished precast concrete segments shall be stored in the Contractor's casting yard or storage facility until the segments are of the age as shown in the following table. Prior to casting the closure at mid-span, the segments shall conform to the minimum age requirements as shown in the following table:

Frame No.	Segment Age at Erection	Segment Age at Closure of Mid-Span
W1, E1	2 months	2 months
W2, E2	6 months	6 months
W3, E3	6 months	18 months
W4, E4	2 months	2 months

The design of these structures is based on the construction sequence, methods, and equipment loads as shown on the plans. Not all details for construction sequence and construction methods are shown.

The Contractor shall develop, verify and provide the Contractor's own sequence, means, and methods that are based on the Contractor's proposed erection equipment, the Contractor's erection schedule, and the Contractor's concrete mix design and actual material properties. Any modification of the plans to accommodate specified options and the Contractor's construction equipment, means and methods shall be performed by the Contractor and submitted to the Engineer for approval as specified in these special provisions.

The Contractor shall submit a detailed construction sequence. The Construction sequence shall conform to the details shown on the plans. At the Contractor's option the following portions of the details shown on the plans may be modified by the Contractor:

A. Order of erection of the four frames.
B. Order of the pipe beam installation at Hinges B, C, and D.
C. Sequence of erection within a given frame including individual segment erection, casting of the counterweight diaphragms, placement of the hinge diaphragms, and placement of the closure pours, except that the segment ages specified in these special provisions and as shown on the plans shall not be reduced
D. Direction and sequence of erection of a hinge pipe beam at a given hinge location.

The work performed by the Contractor for the options listed above shall be in accordance with the following:

A. Project specific design criteria, "Design Criteria, Skyway Structures," dated February 26, 2001, hereafter called the "Project Design Criteria." The project design criteria are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.
B. The applicable provisions of the 1999 AASHTO "Guide Specifications for the Design and Construction of Segmental Concrete Bridges," hereafter referred to as "AASHTO Guide Specifications." as amended by these Special Provisions.
C. The following sections of Division II Construction Specifications of the AASHTO Guide Specifications shall be considered to be applicable: 2.8, 5.1, 8.0, 9.0, 10.0, 11.0, 14.0, and 16.0. Other sections may be included by specific reference in these special provisions.
D. Caltrans Bridge Design Specifications, 1995.

If provisions of the above Project Design Criteria, AASHTO Guide Specifications and the Caltrans Bridge Design Specifications are found to be in conflict, the Project Design Criteria shall govern over the others.

Lifting hoists and strong backs shall be designed, detailed and fabricated in accordance with the applicable provisions of AASHTO Standard Specifications for Highway Bridges, AASHTO Guide Specifications and these special provisions.

WORKING DRAWINGS

The Contractor shall submit working drawings in conformance with Section 5-1.01, "Working Drawings," of these special provisions. Separate working drawing submittals shall be made for the construction sequence and the furnish precast concrete segments.

Construction Sequence

The Contractor shall submit the proposed construction sequence to the Engineer for approval in conformance with the requirements specified herein. The proposed construction sequences shall include:

A. A detailed description of the construction method and construction equipment, with conceptual drawings and calculations.
B. Itemizations of modifications necessary to accommodate the method.
C. A construction schedule showing completion of the project within the stated schedule.

The Contractor shall submit to the Engineer 10 copies of the proposed construction sequence including detailed drawings and calculations. After submitting the proposed construction sequences, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept and to determine whether the construction sequences are feasible. Items of discussion will include permit issues, impact on other adjacent contracts, impact on the project schedule, traffic considerations, safety and health issues, design criteria, and review times required by the Department and other agencies. Determination by the Engineer that the proposed construction sequences will be neither feasible nor acceptable will be deemed rejection of the proposal. The Contractor shall allow 30 working days after the meeting for the Engineer to review the proposed construction sequences. Acceptance of the proposed construction sequences in no way constitutes approval nor guarantees future approval of the Contractor's working drawings and supplement.

Furnish precast concrete segment working drawings and supplement shall be submitted after the Engineer has reviewed and approved, in writing, the Contractor's construction sequence working drawing submittal.

Furnish Precast Concrete Segment

Working drawings shall include complete details, information, and substantiating calculations for the methods, materials, equipment, and procedures the Contractor proposes to use in constructing, handling, storing, and transporting the precast concrete segments. Working drawing submittals shall include the following:

A. Segment formwork and falsework plans including support for precast panels during casting of the segment.
B. Casting cell foundation plans.
C. Form drawings.
D. Layout of the casting yard showing operational features, casting cells, rebar fabrication and material storage areas, moveable rain and sun sheds, geometry control stations, segment handling and storage facilities and the like.
E. All other supplementary plans and similar data required to successfully accomplish the work.
F. Substantiating calculations for the design of falsework, casting equipment, and formwork including the number of uses prior to replacement.
G. Substantiating calculations for other temporary construction which may be required and which will be subject to calculated stresses.
H. Fully and accurately dimensioned views showing the geometry of each segment including all projections, recesses, notches, openings, blockouts, and other pertinent details.
I. Details and dimensions of the anchorage system for the post-tensioning system.

J. Details of nonprestressed steel reinforcing that include size, spacing, and location including any special reinforcing steel required but not shown on the plans.
K. Details of size and type of ducts for all post-tensioning tendons and their horizontal and vertical profiles including the duct support locations, grout tubes, vents and other relevant details.
L. Details and locations of all other items to be embedded in the segments such as inserts, lifting devices, and post-tensioning hardware components. All Contractor added inserts shall be identified for use.
M. Composite placing drawings to scale and in sufficient detail to show the relative positions of all items that are to be embedded in the concrete and their embedment depth. Such embedded items include the prestressing ducts, vents, anchorage reinforcement and hardware, reinforcing steel, anchor bolts, earthquake restrainers, deck joint seal assemblies, drainage systems, utility conduits. Drawings shall show enough details to ensure that there will be no conflict between the planned positions of any embedded items, and that the concrete cover will be adequate.
N. Details of handling and storing segments.
O. Segment shipping and handling plans.
P. A schedule of the timing and sequence of segment casting and erection including the sequence for making cast-in-place closures and continuity between spans.
Q. Details of any localized strengthening necessary for inserts or lifting holes and the materials and methods to fill and finish such holes.
R. Details of any localized strengthening for concentrated supports, loads or reactions from any erection equipment.

A supplement to the working drawings shall include the following:

A. The Contractor's proposed methods of geometry controls for the casting operation and a quality control plan for geometry control. This submittal shall be in the form of a "Casting Manual" and shall include the following:

1. A detailed exposition of the geometry control theory for casting.
2. A detailed narrative of the step-by-step geometry control procedure.
3. Detailed calculation forms, and a set of sample calculations for geometry controls, including sample input and output of computer programs.
4. Identifications of all measuring equipment, procedures, and the location of control points to be established on each segment.
5. The location and values of all permanent bench marks and reference points in the precasting yard.
6. Qualifications of personnel who will carry out geometry control.
7. A geometry control procedure for the vertical and horizontal alignment control of the precasting segments; including survey control and procedures, observations, checks, computational and graphical methods and correction techniques.
8. The casting curves which include the theoretical geometric horizontal alignment, profile grade and superelevation appropriately combined with camber.
9. A production schedule with rates of production and number of casting units.
10. The provisions to protect instruments from construction activities and to minimize the effects of wind and temperature variations on the accuracy of readings.
11. The casting manual shall cover all geometry control operations necessary. It shall be coordinated with the erection manual and shall be compatible with the chosen methods of casting and erection, including erection survey, elevation and alignment control.

B. Calculations of creep, shrinkage, and concrete modulus of elasticity in accordance with the recommendations of CEB-FIP Model Code 1978 for Concrete Structures. These calculations shall be adjusted to reflect the results of the materials tests required for structural concrete specified elsewhere in these special provisions.
C. Detailed calculations for the superstructure and pier stresses accounting for the construction sequence, schedule and material properties:

1. The Contractor shall submit the analysis results that are computed from a time-dependent segmental analysis software program. These results shall be combined with all other required load cases as defined in the Project Design Criteria. The reported resultant stresses shall conform to the requirements as specified in the Project Design Criteria.

2. The Contractor shall use for his time dependent analysis, the creep and shrinkage models based on CEB-FIP Model Code 1978 for Concrete Structures, adjusted to reflect the results of the materials tests required for structural concrete specified elsewhere in these special provisions. The design is based on an ultimate creep coefficient $\varphi c = 2.35$, for the bridge conditions, at a loading age of 28 days and an ultimate shrinkage strain $\varepsilon ult = 224x10\text{-}6$, for the bridge conditions.
3. The Contractor shall request, in writing, from the Engineer, the soil and foundation stiffness defined as vertical, horizontal and rotational springs at the base of each pier and the superstructure and pier force demands due to live load, centrifugal force, wind, wind on live load, longitudinal force from live load, temperature rise and fall, temperature gradient, and seismic forces.
4. The Contractor shall submit design calculations for the completed structure.
5. The calculations submitted by the Contractor shall also include the following:

Calculations including the effects of construction sequence and history as well as the effects of temporary construction loads shall conform to Section 7.4 for the AASHTO Guide Specifications titled "Construction Load Combinations, Stresses and Stability." Pier stresses due to unbalanced cantilever loading shall not exceed:

$$0.62\sqrt{f_c'}\ \text{MPa}$$

Where f_c' is specified concrete strength, for Construction Load Combinations of the AASHTO Guide Specifications.

Calculations showing that for the completed structure, based on the actual construction sequence, erection schedule and the material properties, at the end of construction and at ten years after completion of construction, for load combinations defined in the Project Design Criteria, the maximum and minimum stresses and ultimate strengths conform to the limits defined by the Project Design Criteria.

The stresses in the pipe beams at the hinge locations, at the end of construction and at ten years after completion of construction, for load combinations defined in the Project Design Criteria, shall not exceed $0.66F_y$, where F_y is the yield stress of steel.

Calculations showing that for the completed structure at end of construction and at 10 years after completion of construction, pier force demands shall satisfy the following equation:

$$\frac{M_2}{M_{n2}} + \frac{M_3}{M_{n3}} \le 0.7$$

Where M2 and M3 are factored moments about the longitudinal and transverse axes of the pier based on Table 2.8.1B in the Project Design Criteria, and Mn2 and Mn3 are the longitudinal and transverse nominal flexural capacities of the pier based on a concrete strain of 0.003.

Under no circumstances shall the bending moments about the weak axis at the top and bottom of the piers due to dead load, pre-stressing, creep and shrinkage, at end of construction and at 10 years after completion of construction, exceed 250 MN-m for Frames 1, 2, and 3 and 170 MN-m for Frame 4.

1. Stresses for each segment shall also be calculated and reported for the following intermediate construction stages:

   Immediately after erecting or placing concrete in each segment.
   Immediately after stressing cantilever tendons.
   Immediately prior to, and after jacking operations at closure.
   Immediately prior to, and after, placement of closure concrete.
   Immediately prior to, and after, stressing of the first stage post-tensioning through the closure prior to release of the closure formwork.
   Immediately after the release of the closure formwork.
   Following completion of span post tensioning tendons.

Following completion of continuity post-tensioning tendons.
Prior to and after all steps of hinge construction.
Prior to and after removal of all temporary towers.

B. Camber diagrams, casting curves and erection elevations prepared in accordance with the chosen construction method, sequence and schedule and actual material properties. In this respect, the construction methods, sequence and schedule include, but are not limited to, Contractor adopted general construction techniques, the erection equipment, its deployment and effect upon the structure, the introduction or removal of temporary supports, temporary towers, falsework closure devices and the like, their deployment and effect on the structure, the order (sequence) in which all casting, construction methods and step by step erection operations are executed, including post-tensioning, and the timing (schedule) of all such operations, with respect to the maturity of concrete and affect thereon. The casting curve shall be sufficient accuracy to allow the determination of control point settings for accurately casting the segments. The preparation of casting curve shall recognize all deviations from a straight line and shall include all deviations associated with the required alignment and deformations due to dead loads, future superimposed dead loads, erection loads, post-tensioning forces, secondary moments, time dependent effects of prestress losses, creep and shrinkage of concrete at day 4,000.
C. Supporting calculations for any modifications to reinforcement at anchorages made necessary for accommodating the elected post-tensioning system hardware.
D. Supporting calculations for lifting and storing the segments.
E. Supporting calculations for localized strengthening for concentrated supports, loads or reactions from any erection equipment.
F. Method of mixing and placing grout in accordance with the current schedule; equipment description and capacity (including standby flushing equipment); and mix design.
G. The volume of concrete, the weight of reinforcement and the weight of post-tensioning in each precast segment and the totals of these for both the superstructure and substructure summarized and tabulated on shop drawings.
H. Methods of vibration during the concrete placement, including complete placing plan, the number of lifts, lift height, crew size, number of vibrator or vibration devices, and coordination of vibration and cure.
I. Type of cure and schedule for cure.
J. Schedule of form removal.

After a complete submittal has been received, as determined by the Engineer, the Contractor shall allow the Engineer 50 working days to review the complete submittal.